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Selection

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VIEW FROM MR. BURBANK'S GARDEN, SANTA ROSA, CALIFORNIA

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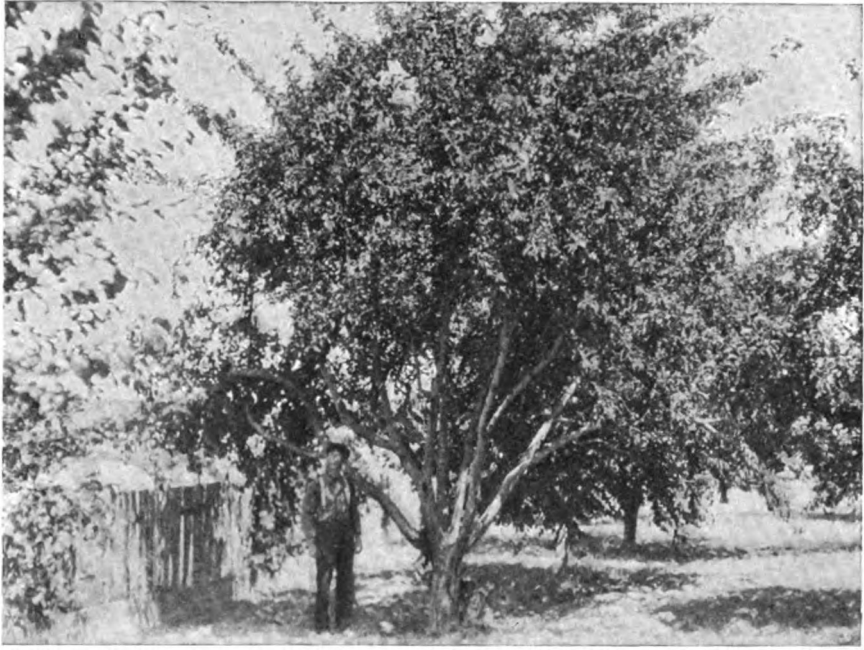


FIRST crossing, to secure variation and break up established habits; then selection, to isolate and develop the new forms in which the master's eye sees the indications of future usefulness, beauty and permanence- such is the formula for the transformation of the plant - world, whose beginnings have drawn all eyes upon Luther Burbank.

After all, there is some verisimilitude in

likening his operations to those of a wizard. The old magicians could not always foresee what spirits their necromancy would call forth-and no more can this modern conjurer of science. We have seen that by crossing a raspberry with a blackberry he produced a valuable new species of fruit. But when he crossed the raspberry and the strawberry, a strange thing was summoned into existence-a plant without the thorns of the raspberry, but with the leaves and stolons of the strawberry, shooting up canes to the height of a man's

•See "Transforming the World of Plants" in the November Cosmos.



APPLE-TREE AT SEBASTOPOL, BEARING FIVE HUNDRED AND TWENTY-SIX VARIETIES

shoulder, bursting into an astonishing bloom of flowers such as neither the strawberry nor the raspberry plant ever knows, and finally, after all this brilliant preparation, producing, instead of berries, insignificant unmaturing knobs!

Then he boldly crossed the blackberry with the apple. One can imagine what a successful combination of those species into an entirely new fruit might have meant. The result, however, was a plant, sprouting from blackberry seeds, that resembled a little apple-tree in foliage and growth, having no thorns, and putting forth beautiful rose-colored flowers, but alas! no fruit.

Scores of similar crossings have been made, hundreds of thousands, and even millions, of plants have been produced, examined, judged, and out of all these multitudes a few individuals have been found worthy of preservation and cultivation, while the others have been brought into existence only to be destroyed again. Some of these rejected forms, springing from who knows what ancestral traits, have

been put to death on sight, for they were vegetable monsters, which ought not to live! Yet side by side with strange and undesirable forms, come forth occasionally shapes of astonishing beauty, and plants endowed with matchless virility and fruitfulness. One of Mr. Burbank's hybrid chestnuts, selected from thousands of varying forms produced by the crossings, bears nuts almost two inches in diameter, when it is but eighteen months old! And excellent nuts they are, bowing with their weight the slender branches of miniature trees only three feet tall.

But, while the process of crossing is freely employed in order to obtain a great variety of new forms to work upon, and to obtain them quickly and rapidly, yet marvels are accomplished by simply following up the hints which nature gives in her spontaneous though evanescent variations. The suppressed, unfavored life-forces are like a myriad of dim eager faces, hidden behind nature's draperies--starved, neglected children for whom there is no room and no hope, whose mother amid a mul-

titude of pressing duties has no time, no thought and no place for them. Yet, occasionally, one peeps forth with momentary boldness only to be rudely thrust back from the unfriendly and impenetrable throng of **extant** existences. Such an in- cident forms one of the opportunities for which the experimenter watches, ready to extend a helping hand. The story of how Mr. Burbank developed his crimson poppy is an instance in point. The fields of California at certain seasons are splendid with the yellow flowers of a native poppy. The under side of the flower shows crimson streaks, but there is never any crimson on the upper, or inner, side. A few years ago Mr. Burbank found one of these flowers in which, as President David Starr Jordan describes it, "the outside crimson had struck through like a crimson thread which had been misplaced." That was all that was needed; the timid, peeping, new face had been recognized, a friendly eye had

eration, until within a few years he had produced a new variety of poppy, turned from yellow to crimson, and capable of perpetuating its kind. It was only last year that this process was completed.

I have told how the new kind of berry, the primus, was produced by crossing the raspberry-and the blackberry. Mr. Burbank's latest production in the way of a new fruit, the "pomato," is an example of the method of selection without previous crossing, and so it falls into the same class with the crimson poppy. The pomato gets its name from the fact that it is a fruit resembling a tomato growing on a potato-plant. The plant from which it has been developed was originally a wild variety of potato, found in the Southwest, which showed a tendency to produce "balls" on the vines at the expense of the root-tubers. Mr. Burbank saw that these potato-balls, rudimentary examples of which are common on potato-plants, could be developed

into a desirable fruit resembling the tomato . By the simple process of se lectio n, as in the case of the crimson poppy, he succeeded, in th e course of about five years, in training the plants to grow to several times the siz e of ordinary potato-plants, and to produce, in- stead of the origin al sma ll, hard, bitter, green ba Us, a fine white fruit, from an inch and a quarter to an inch and a



CHEST NUT - T REES E IGH T EEN MONTHS OLD ,
BLI::ARI I'G NUTS

seen it, and the skill tha t could make room for it was at hand ready to be exerted. fr . Burbank took the var i- ant flower, which nature wou ld quickly hare su rressed, and planted its seeds, and from the resulting plant he chose those blossoms in which the most crim- son showed, and planted their seeds, and so season **after** season he encour- aged, protected and developed the

strange flower, which blushed redder and redder with each succeeding gen-



LARGE NUTS BOR:-;E ON THE EIGHTEEN-MONTHS-OLD
CHEST:-:UT-TREES

half in diameter, with a tender skin like that of a tomato, although the fruit is more regular in shape than the tomato, and with a savory pulp having a high flavor and a pleasing fragrance. The pomato is delicious when eaten raw from the hand, and particularly fine as a preserve,

or when cooked for the table. No doubt of plants, and what a light it casts upon can be entertained that this new garden-fruit will be extensively introduced and cultivated.

One more example of the wonderful effects of selection when guided by the hand of genius, before we turn to consider the most beautiful creations of Mr. Burbank in the realm of the flowers. The example I have in mind is the "Bartlett plum," surely one of the most astonishing fruits in existence, and a very striking instance of the force of education. It happened,

years ago, that Mr.

we say of the fact that the plum-tree which bears the "Bartlett plums" presents some of the characteristics of a Bartlett pear-tree, although nowhere in its known ancestry has it been crossed with a member of the pear tribe? What a glimpse this opens into the infinite complexity of the history

Mr. Burbank's dictum that "*Heredity is tire sum of all past environment*" I

It may have occurred to the reader that there is something like wizardry in the rapidity with which Mr. Burbank brings his new kinds of plants to maturity, considering that the methods employed require the accumulated effects of successive generations. This is largely explained by the resort to grafting. Seedlings of a new variety of plant or tree are



THE PLUM-TREES JUST GETTING A MOVING

often grafted upon an

Burbank noticed in a plum taken from one of his trees a slight suggestion of the flavor of the well-known Bartlett pear. Mr. Burbank treasured the pit of that peculiar plum as if it had been a diamond, and, pursuing a method similar to that described in the case of the pomato, he gradually developed a new kind of plum, which has now attained a state of complete stability, a plum which, it is soberly averred, has more distinctly the flavor of the Bartlett pear than the pear itself has! And what shall

old plant or tree, and thus are pushed ahead, and hurried onward, in the race of life. They get the benefit of the strength and virility of the older plant from whose fully developed circulation they draw their nourishment. Among the curious sights in Mr. Burbank's grounds at Santa Rosa and at Sebastopol are trees hundreds of whose branches are "strangers to the blood" of the tree that bears them. One has no fewer than five hundred and twenty-six varieties of apples growing upon its grafted branches-

green apples, yellow apples, round apples, bell-shaped apples, sweet apples, sour apples - and the seed of each of these can be separately experimented with.

But let us turn to the flowers. The fame of the Sparta daisy has already gone round the world, and we need not dwell upon the story of the development of that magnificent sunburst of a flower from the little despised daisy of the fields. Daisies are among Mr. Burbank's favorites and he has not ceased to shape them, season after season, to the bent of his fancy. To make daisies grow tall, graceful and aristocratic, and to inspire them with such pride of beauty that they expand **their** gold-centered blossoms to a diameter of six inches, was not enough. Every succeeding year **he** makes them more beautiful, with a more elegant carriage. During the present year he has developed a new variety of daisy which he thinks will surpass all known varieties in grace though not necessarily

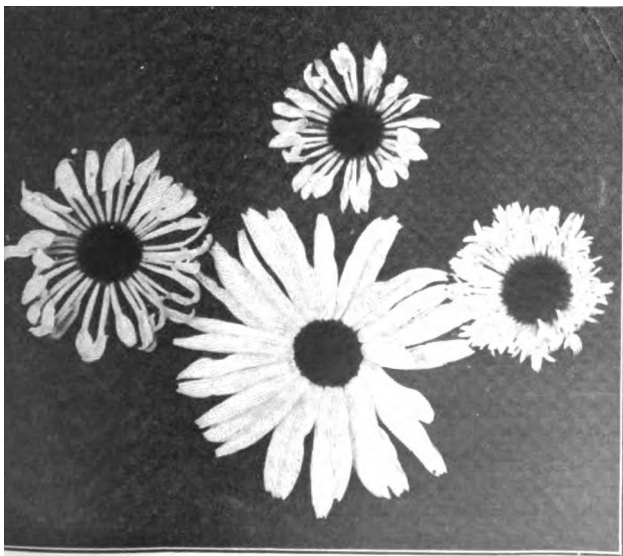


MR. BURBANK POLLINATING A POPPY-FLOWER TO PRODUCE A CROSS

in size. The refinement of Mr. Burbank's methods when he is engaged with the development of the beauty of a new flower

is surprising. No least feature is overlooked. The shapes of the petals, the bordering of the edges, the tone of the colors, the droop of the stem, the general carriage of the whole plant-these and a hundred other particulars are carefully noted, and when **the** work is completed you have Mr. Burbank's mind mirrored in a flower, quite as truly as the mind of an artist is expressed in a painting. It is a touch characteristic of the man that when he is selecting a flower for color he is accustomed to submit it to the choice of a lady of fine and cultivated tastes.

I have already remarked upon his intellectual fearlessness. Standing with him among a multitude of new varieties of flowers one day, and noticing the tenderly affectionate and yet master-



OP ONK CROSS-POLLINATED PLANT

ful way in which he handled them, selecting, approving, rejecting, at a glance or a touch, I could not but say to him:

"Mr. Burbank, these are all reflexes from you. Do you not sometimes feel almost as if you were exerting a psychic force upon these plants; that in some way, not yet expressible in scientific terms, they are following the suggestions of your imagination?"

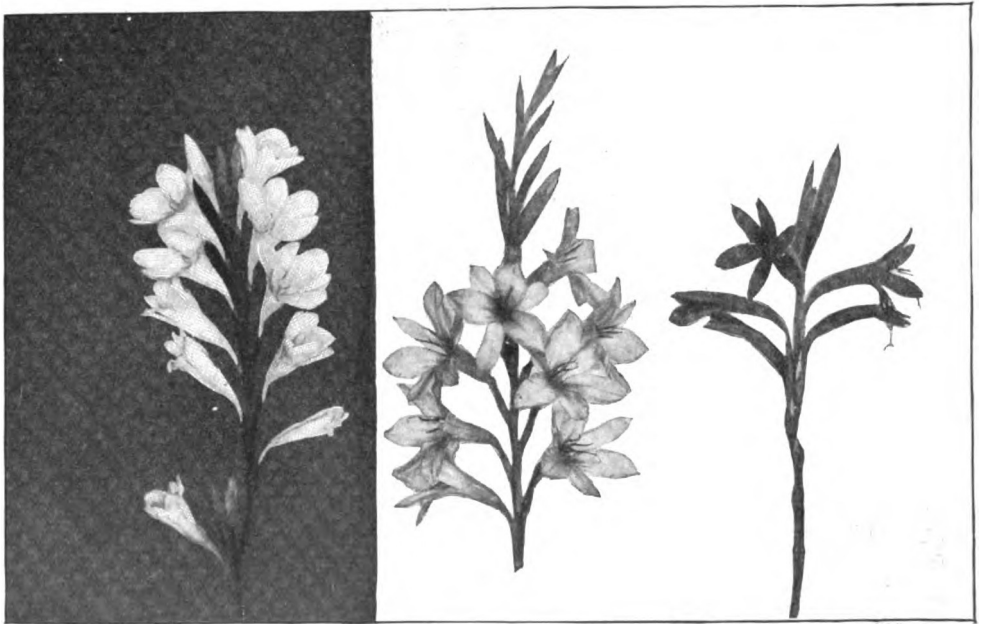
But it was no new thought to him.

"Yes," he said; "why not?"

Another flower whose introduction dates from the present year is a splendid new

a reddish-purple four-winged center spot, encircling a greenish-white coronet-shaped seed-vessel. The whole aspect of the flower is extremely elegant and attractive.

One of our photographs shows Mr. Burbank in the act of producing an artificial cross. In one hand he holds a flower of the *Papaver pilosum*, placed close to a peony poppy. With a camel's-hair brush he takes the pollen from the stamens, or anthers, of the first-named flower, which in this case plays the part of the male parent of the cross, or hybrid, that is to be produced, and places it upon the stigmas

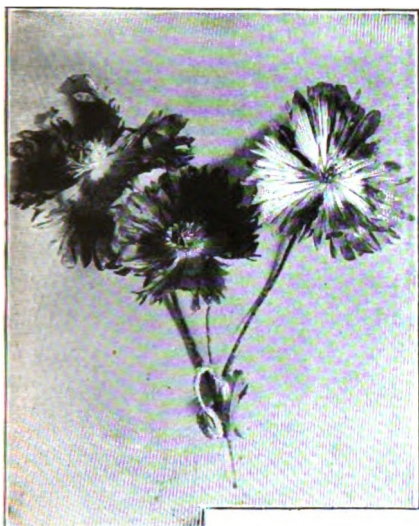


A NEW VARIETY OF WATSONIA PRODUCED BY CROSSING AND SELECTION. FROM LEFT TO RIGHT, MOTHER BLOSSOM (WHITE), FATHER (ORANGE-RED), OFFSPRING (ROSE-PINK)

poppy which will probably be known in scientific nomenclature as *Papaver Burbankii*. It is the result of crossing the common white peony poppy with the *Papaver pilosum*, the first-named being the mother plant, and the last the father. Our illustrations show the characteristic forms of the flowers and leaves of the parent plants and of their offspring. But in this case, at least, color plays an even more distinctive part in the transformation than does shape. The peony poppy is splendidly white, the *Papaver pilosum* possesses a deep ecru hue, while the new poppy is of a brilliant fire-red color with

covering the pistil of the white poppy, which is to be the mother plant. This act is called "pollinating the flower." When the pollination, or fertilization, is completed, the flower that has been thus treated is carefully protected (say by covering it with a paper bag as it grows on its stem) from any further accidental contact with pollen carried by insects, or by the wind.

When the seeds of the artificially pollinated flower have ripened, they are sown, and the plants that spring up from them will contain a mingling of the hereditary characteristics of the two parents. A considerable variety of forms will be ex-



NEW POPPY OF
FIRE-KED COLOR

distributed by the individual plants sprung from this seed, and if afterward a second crossing is effected, the number of variations produced will be greatly increased.

All sorts of latent traits now make their appearance. The hidden children burst

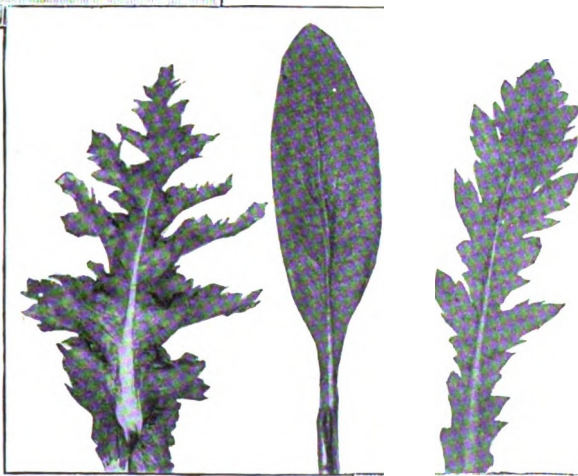
forth in a wild crowd! But having made his selections, the experimenter allows all the other forms to disappear, and in a few generations (plant generations) the chosen ones become fixed new varieties or species. On the average, Mr. Burbank finds that about half a dozen generations are required for this purpose. The mutation theory of Professor De Vries cannot stand in the light of Mr. Burbank's experiments, because while that theory assumes that only at certain periods in the life of plants do sudden mutations, producing new species, take place, the experiments demonstrate that man can produce mutations whenever he wills it, and that "mutation is not a period but a state." The so-called Mendelian laws are proved by these experiments to be inadequate,

because they are found to apply only in a limited number of cases. Mr. Burbank's operations have been conducted on so gigantic a scale that, for breadth of view, he has the same advantage over other experimenters that one standing on the summit of a dominating mountain possesses over those who have climbed only to the top of a foothill. Finally, his experiments have proved the falsity of the doctrine that acquired characteristics are not transmitted.

We have been drawn a little aside from the description of the new flowers because it is essential, at every step, to keep prominently before the mind the meaning of what Mr. Burbank has done and is doing, and the effect of his achievements upon scientific views and theories.

Space remains to refer briefly to a few more of the beautiful things that may be seen in the

gardens at Santa Rosa and the experimental grounds at Sebastopol. And yet no one can describe these flowers! Their immense number and variety are as astonishing as is their beauty of



LEAF OF NEW POPPY, WITH LEAF OF
FATHER AND OF MOTHER PLANT
(RIGHT TO LEFT)



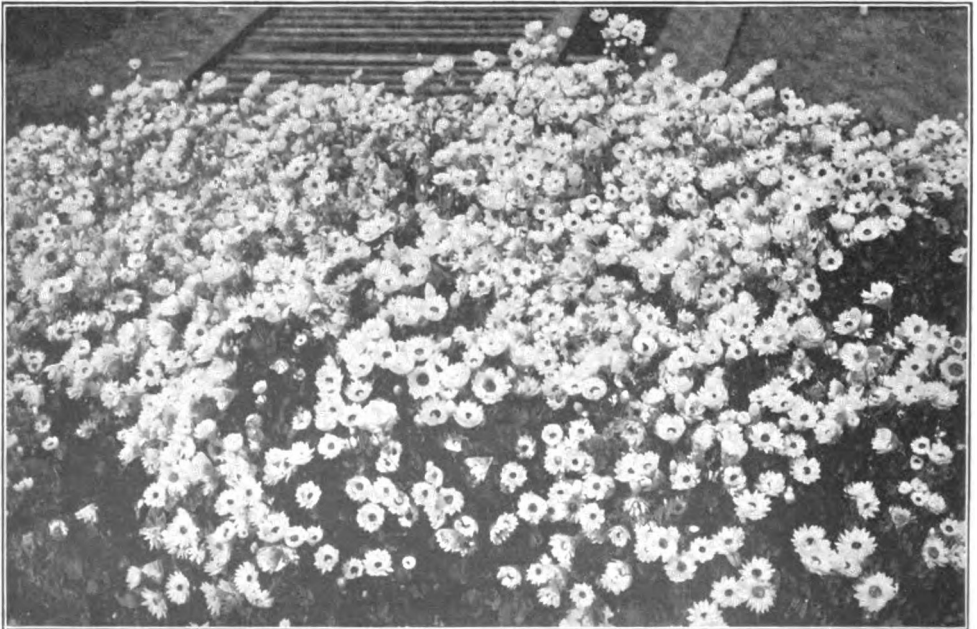
MOTHER OF NEW POPPY (LEFT), CENTER, COLOR
WHITE, FATHER BLOSSOMS AT SIDE, COLOR
DEEP-ECRU

form and color. There are the hybrid callulies, great splendid blossoms, a single specimen of which would confer distinction upon any garden; there are the huge amaryllises, newqueens of flowers; there are the gladioli, taught new graces and trained to grow all round their stems; there are geraniums, of a size and splendor that no man ever saw before; there are verbenas that have borrowed a fragrance unknown to their kindred and are now filling the air with the sweet scent of the trailing arbutus; there are new poppies, new and sweet-scented dahlias, new larkspurs, new tiger-lilies- but it is almost an endless story.

There was once a flower growing at Santa Rosa which, in view of its subsequent history, I would have given much to see-a hybrid *M esembrianthemum*, a plant without sufficient native distinction to have a popular name. But, led by some dim suggestion of hidden beauty which he alone could perceive, Mr. Burbank took this insignificant flower and, by crossing and selection, produced a bed of delicate little pink-white blossoms, which for four years were the admiration of all beholders. Then, suddenly, without discoverable cause, every one of these new plants died. It is said that they all perished in a night, as if the breath of a pes-

tilence had blown upon them alone, leaving their stately companions in the garden of beauty untouched and unharmed. They had looked out upon the world and charmed it for a few brief seasons, but its touch was too rough, and they quickly shrank into the habitation of forgotten forms. No human eye may ever see their like again, for years of experimentation had been required to bring them forth, and they left not a seed nor a living root!

But the field from which these things may be developed is illimitable, and Mr. Burbank is only at the beginning of his work. With his hybrid thornless and spiculeless cactuses, bearing rich and nourishing fruit, and juicy stems, which may turn arid deserts into populated plains; with his fruit-trees taught to withstand the frost, and his grains educated to defy the drought; with his continually growing array of new plants, new plums, new cherries, new apples, new berries, new fruits never before seen in orchard or garden, new flowers never before dreamed of by florists-with all these, still the greatest part of his career, we may hope, is before him. And wider yet will be the effect of his example and the inspiration of his genius upon others who shall take up the work after him.



HEIL OF EVERLASTING FLOWERS, BEING TRAINED TO GROW DOUBLY